

**WHAT IS CLAIMED IS:**

- 1                   1.     A filter cleaning device comprising:  
2                   a) a cleaning fluid delivery device for providing a cleaning fluid;  
3                   b) at least one actuator;  
4                   c) a controller with logic for instructing said actuator to automatically  
5 move at least a portion of the cleaning fluid delivery device along a path across a  
6 surface of the filter to spray the cleaning fluid onto the filter; and  
7                   d) a collector positioned to receive waste material released from the  
8 filter during a filter cleaning event.
- 1                   2.     The device of claim 1 wherein said cleaning fluid delivery  
2 device includes a nozzle that translates across the surface of said filter in two  
3 perpendicular axes.
- 1                   3.     The device of claim 1 wherein said cleaning fluid delivery  
2 device includes a nozzle that moves across the surface of the filter along a path  
3 selected from one of the following: a rotational path, a curved path, or a spiral  
4 path.
- 1                   4.     The device of claim 1 wherein said path is a predetermined  
2 path.
- 1                   5.     The device of claim 1 wherein the cleaning fluid delivery  
2 device comprises a nozzle coupled to an arm that is moved by said actuator that  
3 guides the nozzle across the surface of the filter.
- 1                   6.     The device of claim 1 wherein the cleaning fluid delivery  
2 device comprises flexible duct coupled to a source of high pressure fluid.
- 1                   7.     The device of claim 1 wherein the cleaning fluid delivery  
2 device comprises means for delivering fluid to the filter.
- 1                   8.     The device of claim 1 wherein the cleaning fluid delivery  
2 device is moved along a path to provide a substantially uniform level of cleaning  
3 of said surface of the filter.

1                   9.     The device of claim 1 wherein said collector comprises  
2     ducting which carries cleaning fluid and material released from the filter through a  
3     filtering device and a suction device.

1                   10.    The device of claim 9 wherein said filtering device is selected  
2     from one of the following: a HEPA filter or a ULPA filter.

1                   11.    The device of claim 1 wherein said filtering device is selected  
2     from one of the following: a HEPA filter or a ULPA filter.

1                   12.    The device of claim 9 further comprising a second filtering  
2     device positioned downstream of said vacuum device, said second filtering  
3     device capturing materials flowing out from the vacuum device.

1                   13.    The device of claim 9 wherein said second filtering device is  
2     a diesel particulate filter.

1                   14.    The device of claim 9 wherein said second filtering device is  
2     a ceramic wall-flow particulate filter.

1                   15.    The device of claim 1 wherein said collector includes at least  
2     one of: a HEPA filter or a ULPA filter.

1                   16.    The device of claim 1 wherein said controller can pulse the  
2     cleaning pressure and fluid flow rate from the delivery device.

1                   17.    The device of claim 1 wherein said fluid delivery device is  
2     coupled to a pulsing fluid source for pulsing the cleaning pressure and fluid flow  
3     rate from the delivery device.

1                   18.    The device of claim 1 wherein controller automatically  
2     determines when to stop a cleaning event.

1                   19.    The device of claim 1 further comprising a heating device for  
2     heating cleaning fluid prior to use on the filter.

1                   20.    The device of claim 1 further comprising a fluid flow sensor  
2   positioned to determine if a section of filter below the nozzle is more or less  
3   clogged with particulate mater than regions of the filter around the section.

1                   21.    The device of claim 1 further comprising an air blower to  
2   direct flow in the direction opposite to the previously applied cleaning fluid to  
3   determine a pressure drop across the filter.

1                   22.    The device of claim 1 wherein said controller instructs the  
2   actuator to move a nozzle of the delivery device at a relatively uniform distance  
3   from the surface of the filter.

1                   23.    The device of claim 1 further comprising an electrical heating  
2   element and supplementary air supply.

1                   24.    The device of claim 1 wherein the delivery device is adapted  
2   for use with a suction mask to focus suction on the filter.

1                   25.    The device of claim 1 wherein the filter is coupled to an air  
2   blower and heater-based regeneration system positioned to heat the filter prior to  
3   application of the cleaning fluid.

1                   26.    The device of claim 1 further comprising a system wherein a  
2   pressure drop across the filter in the reverse direction of cleaning fluid flow is  
3   used as a process diagnosis.

1                   27.    The device of claim 1 further comprising a system with  
2   reverse flow method of process diagnosis coupled to the filter.

1                   28.    The device of claim 1 wherein the actuator rotates the filter  
2   while the nozzle sprays cleaning fluid onto the filter.

1                   29.    The device of claim 1 wherein the actuator rotates the filter  
2   and rotates the nozzle about an axis outside of the filter to deliver cleaning fluid to  
3   said filter.

4                   30.    The device of claim 1 wherein the actuator rotates a  
5 rectangular nozzle about the central axis of the filter to deliver cleaning fluid to  
6 said filter.

1                   31.    The device of claim 1 wherein a cleaning fluid nozzle may be  
2 mounted to a plunger attached on the translation arm, said nozzle is pushed  
3 down and held in contact with the face of the filter and allows the nozzle to follow  
4 the contours of the surface of filter.

1                   32.    The device of claim 1 wherein a nozzle is made of an  
2 abrasion resistant plastic.

1                   33.    The device of claim 1 wherein a nozzle on the cleaning  
2 device moves through a pre-programmed set of positions, and optionally  
3 monitors the flow rate at each position.

1                   34.    The device of claim 1 further comprising a blower wherein  
2 the blower is switched to direct the flow of blower into the DPF in the direction  
3 opposite to the previously applied cleaning fluid.

1                   35.    The device of claim wherein the pressure drop across the  
2 DPF is measured using the pressure sensor and this value is compared with a  
3 previously determined pressure drop for a clean filter.

1                   36.    The device of claim 1 further comprising a cleaning fluid  
2 heater.

1                   37.    The device of claim 1 wherein said collector includes a  
2 plurality of filtration stages.

1                   38.    The device of claim 1 further comprising a mask having an  
2 uncovered section by focusing the suction force on a small area, thus  
3 concentrating the suction near the region that is being treated with compressed  
4 air. The mask is essentially a disk from which an arc has been cut,.

1                   39.    The device of claim 1 wherein a nozzle travels a path across  
2 the filter until it reaches the center of the filter wherein a limit switch is engaged

3 which deactivates the main power relay that then in turn de-energizes the  
4 solenoid, motor, and vacuum.

1 40. The device of claim 1 wherein the actuator rotates a multi-  
2 port nozzle about the central axis of the filter to deliver cleaning fluid to said filter.

1 41. A filter cleaning device comprising:  
2 a) a rotatable platform to which the filter is mounted;  
3 b) a nozzle mounted to a moving arm for providing a high pressure  
4 cleaning fluid;  
5 c) a controller with logic for instructing actuators to move the  
6 rotatable platform and the arm; and  
7 d) a collector positioned to receive material which is released from  
8 the filter during a cleaning event.

1 42. A method of filter cleaning, the method comprising:  
2 a) using a cleaning fluid delivery device to providing a cleaning fluid;  
3 b) using a controller to instruct an actuator to automatically move at  
4 least a portion of the cleaning fluid delivery device along a path across a surface  
5 of the filter to spray the cleaning fluid onto the filter; and  
6 c) using a collector positioned to receive waste material released  
7 from the filter during a filter cleaning event.

1 43. The method of claim 42 wherein said automatically move  
2 comprises translating a nozzle across the surface of said filter in two  
3 perpendicular axes.

1 44. The method of claim 42 wherein said automatically move  
2 comprises moving a nozzle across the surface of the filter along a path selected  
3 from one of the following: a rotational path, a curved path, or a spiral path.

1 45. The method of claim 42 wherein said path is a  
2 predetermined path.

1                   46.    The method of claim 42 wherein said automatically move  
2   comprises moving a nozzle coupled to an arm by said actuator that guides the  
3   nozzle across the surface of the filter.

1                   47.    The method of claim 42 further comprising using a flexible  
2   duct coupled to a source of high pressure fluid to deliver said fluid.

1                   48.    The method of claim 42 wherein the cleaning fluid delivery  
2   device is moved along a path to provide a substantially uniform level of cleaning  
3   of said surface of the filter.

1                   49.    The method of claim 42 wherein said collector comprises a  
2   filtering device and a suction device.

1                   50.    The method of claim 36 further comprising using a second  
2   filtering device positioned downstream of said vacuum device to capture  
3   materials flowing out from the vacuum device.

1                   51.    The method of claim 36 wherein said second filtering device  
2   is a diesel particulate filter.

1                   52.    The method of claim 36 wherein said second filtering device  
2   is a ceramic wall-flow particulate filter.

1                   53.    The method of claim 42 wherein said collector includes at  
2   least one of: a HEPA filter or a ULPA filter.

1                   54.    The method of claim 42 further comprising pulsing the  
2   cleaning pressure and fluid flow rate from the delivery device.

1                   55.    The method of claim 42 wherein said fluid delivery device is  
2   coupled to a pulsing fluid source for pulsing the cleaning pressure and fluid flow  
3   rate from the delivery device.

1                   56.    The method of claim 42 wherein said controller automatically  
2   determines when to stop a cleaning event.

1                    57.    The method of claim 42 further comprising using a heating  
2    device for heating cleaning fluid prior to use on the filter.

1                    58.    The method of claim 42 further comprising using a fluid flow  
2    sensor positioned to determine if a section of filter below the nozzle is more or  
3    less clogged with particulate mater than regions of the filter around the section.

1                    59.    The method of claim 42 further comprising using an air  
2    blower to direct flow in the direction opposite to the previously applied cleaning  
3    fluid to determine a pressure drop across the filter.

1                    60.    The method of claim 42 further comprising moving a nozzle  
2    of the delivery device at a relatively uniform distance from the surface of the filter.

1                    61.    The method of claim 42 further comprising using a suction  
2    mask with the delivery device to focus suction on the filter.

1                    62.    The method of claim 42 wherein the filter is coupled to a  
2    heater-based regeneration system positioned to heat the filter prior to application  
3    of the cleaning fluid.

1                    63.    The method of claim 42 further comprising using a system  
2    with reverse flow method of process diagnosis coupled to the filter.

1                    64.    The method of claim 42 further comprising using a pressure  
2    drop across the filter in the reverse direction of cleaning fluid flow as a process  
3    diagnosis.

1                    65.    The method of claim 42 wherein the actuator rotates the filter  
2    while the nozzle sprays cleaning fluid onto the filter.

1                    66.    The method of claim 42 wherein the actuator rotates the filter  
2    and rotates the nozzle about an axis outside of the filter to deliver cleaning fluid to  
3    said filter.

4                    67.    The method of claim 42 wherein the actuator rotates a  
5 rectangular nozzle about the central axis of the filter to deliver cleaning fluid to  
6 said filter.

1                    68.    The method of claim 42 wherein the actuator rotates a multi-  
2 port nozzle about the central axis of the filter to deliver cleaning fluid to said filter.